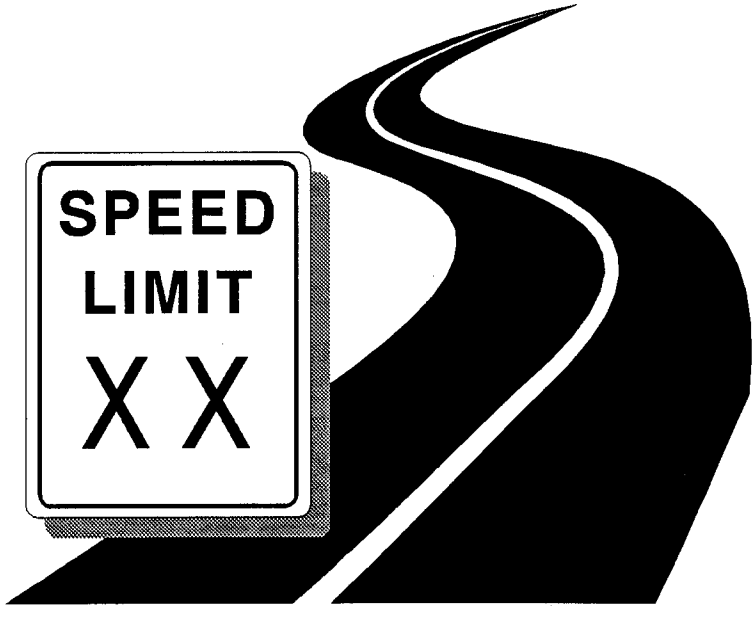
Speed Zoning

for

Highways,

Roads, and Streets

in Florida



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NOTE: For the foreseeable future the units for signs that the public sees will remain in miles per hour (mi/h). Existing speed signs are in miles per hour, and the end result of traffic studies of speed will be in miles per hour. Therefore, for practical reasons, this manual uses only miles per hour units for speed studies.

Speed Zoning for Highway, Roads, and Streets in Florida

1.1 PURPOSE

The Speed Zoning for Highway, Roads, and Streets in Florida Manual has been prepared by the Florida Department of Transportation in compliance with Chapter 316 of the Florida Statutes in order to promote uniformity in the establishment of state, municipal, and county speed zones throughout the State of Florida.

A speed limit sign is neither a costly nor complicated traffic control device, but more than any other, it is responsible for communicating a basic element of safe driving to the motorist and could be responsible for drivers' personal contact with law enforcement officers. Uniform, safe vehicle speeds can only be achieved through consistent methods of speed zone establishment, uniform sign design and placement, and effective speed zone enforcement. This manual seeks to fulfill a large measure of this need by explaining the principles, philosophies, and procedures of realistic speed zoning.

The statutory or blanket speed limits which appear in state statutes prevail on the types of roads and/or the locations identified in the statutes. Such speed limits may be altered upward or downward by speed zoning, thus creating specific, altered speed limits or restrictions for prescribed segments of highways, roads and streets by state, county, or city governments under whose jurisdiction the facility falls. Statutory limitations however, establish maximum speed limits for state, county, and city road systems. According to Section 316.187, F.S., the maximum allowable speed on limited access highways is 70 mi/h. The maximum allowable speed on any other highway which is outside an urban area of 5,000 or more persons and which has at least four lanes divided by a median strip, is 65 mi/h. The maximum speed on other state roadways is 60 mi/h. The maximum speed on city and county roadways is 60 mi/h.

Any alteration and posting of speed limits on municipal or county streets and roads, as set forth in Section 316.189, F.S. must be based upon an engineering and traffic investigation as promulgated herein by the Florida Department of Transportation. Altered speed limits established solely on the basis of opinion are considered contrary to the intent of the statute.

This manual includes procedures and practices for performing engineering and traffic investigations related to speed zoning, plus information on the philosophy of speed zoning and the identification of some of the factors to be considered in establishing realistic, safe, and effective speed zones to which meaningful enforcement can be applied.

Throughout this and many other sources on vehicular speed, the terms speed zone, speed limit, and speed restriction are used interchangeably.

1.1.1 Forms Access

The following form is available through the OfficeVision Forms Library:

750-010-03 Vehicle Spot Speed Study

This form is incorporated by referenced into Rule 14-15, Florida Administrative Code, and any revisions, additions or updates to this form must be coordinated with the Office of the General Counsel for Administrative Code Update.

2.1 INTENT OF SPEED ZONING

The primary intent in the establishment of a speed zone is to provide improved vehicular and pedestrian safety by reducing the probability and severity of crashes.

A speed limit sign notifies the driver of the maximum and/or minimum speed that is considered acceptably safe for optimum weather and visibility. It is intended to establish the standard or speed limit(s) within which the normally prudent driver can react more safely to driving problems encountered on the roadway.

It is common traffic engineering knowledge that about 85 percent of drivers travel at reasonably safe speeds for the various roadway conditions encountered, regardless of speed limit signs. It is for those drivers who don't, that the practice of speed zoning does take place, to provide realistic speed restrictions to which meaningful enforcement can be applied.

3.1 DRIVER BEHAVIOR

The vehicle speed chosen by a driver may be influenced by, the presence of other vehicles, weather, road conditions, road geometrics, adjacent land use, and other factors shown in this manual. A driver's choice of speed is a balance between expedience and safety, and is often a subconscious reaction to the environment.

Unfortunately, speed law enforcement appears to have little permanent affect on driver behavior. Much of the driver's attitude which influences his voluntary observance of the legal posted speed limit is probably derived from the wide variation found in speed zoning practices, the degree of enforcement, and the differing tolerances permitted by the enforcement agencies. Motorists tend to pay little attention to speed limit signs, which they consider unreasonable, unless there is an inordinate degree of enforcement. Unreasonably low speed limits are commonly violated by a majority of motorists, making enforcement difficult, with resultant operating speeds sometimes higher than would exist with proper, realistic speed limits.

Most drivers on a section of road move at a reasonably safe speed, based on their conscious and subconscious reaction to many factors. By obtaining a true measure or profile of their speed range, a speed can be chosen which is realistic in terms of providing a limit beyond which enforcement can be applied. As an oversimplification of the procedure, it can be said that drivers, without knowing it, determine their own speed limit.

Some motorists drive persistently fast (faster than would be considered normal for road and roadside conditions), while others drive persistently slow. Although both are disruptive to safe traffic operations, the former is the category toward whom speed zoning is directed. The following factors influence a drivers choice of speed.

- Time of day
- Purpose of trip
- Ambient light
- Weather
- Type of vehicle
- Presence and/or history of enforcement (personnel or officially marked vehicle)
- The interval since witnessing a crash or results of a crash
- Running speed for previous 5 or 10 miles of travel
- Adjacent land use
- Recent traffic violation and points accrued
- Pavement wetness (including standing and running water)
- Snow, ice, mud and sand on pavement
- Alcohol and/or other drugs in the driver's bloodstream
- Personal schedule of driver (late or on time)
- Length of trip
- Number of passengers
- Type of passengers
- Familiarity of driver with road
- Condition of vehicle
- Urgency of trip
- Driver skill
- Personality of driver
- Emotional condition of driver
- Lane width
- Speed of other vehicles
- Vehicle parking
- Shoulder width and condition
- Restrictive lateral clearance
- Pavement type and condition
- Pavement roughness
- Traffic volume
- Pedestrians, especially children
- Presence and location of pedacyclists

Although the cause and effect of all these factors may not be germane to this manual, they should be recognized as factors which clearly influence the speed at which a motorist travels at any given moment.

4.1 TRAFFIC ENGINEERING INVESTIGATIONS

Florida Statutes require that the alteration of speed zone values contained in Sections 316.187 and 316.189, F.S. be based on an engineering and traffic investigation. This investigation would include, but is not limited to, the measurements of speed test runs, and other traffic engineering evaluations contained in this manual. Both Section 5.1 (Equipment, Conditions, and Data Collection Sites) and 14.1 (Speed Zone Locations) explain exceptions to the practice of collecting and analyzing speed data.

4.1.1 Basic Investigations

The measurement of prevailing speeds of free-flowing traffic during good weather and roadway conditions is the prime requisite in establishing a speed limit. Three types of data are utilized in determining the prevailing speed: 85th percentile speed, upper limit of 10 mi/h pace, and Average Test Run Speed. The first two result from measuring the speed of many vehicles (called either a speed check or spot speed study) and the third results from the speed of an observer's vehicle which is driven through the area a number of times.

The 85th percentile speed is the speed at or below which 85 percent of the observed free-flowing vehicles are traveling. The 10 mi/h pace is the 10 mi/h range containing the highest number of such vehicles contained in the study sample data. The Average Test Run Speed is measured by agency vehicles and is associated with low volume facilities where a sufficiently large number of vehicles cannot be observed in a reasonable period of time.

The speed distribution curves (Figures 1, 2, and 3), the field data collection sheets, and the number and percentage of vehicles within the 10 mi/h pace all reveal important information about speed. The less variation in vehicular speed at a particular location, the safer the conditions will be. If all vehicles would travel at near the same speed, there would be little reason for passing on two-lane roads and much less reason for lane changing on multi-lane roadways. This would result in lower rear-end, head-on and side-swipe traffic crashes.

Experience has shown that realistic speed limits (developed by the procedures outlined in this manual) will reduce the variance of speeds even though the average, mean, or 85th percentile speed may not change appreciably. This reduced range will result in a higher percentage of vehicles within the 10 mi/h pace and will be revealed on the speed distribution curves by a narrow width of the Bell-Shaped curves shown in Figures 1 and 2 and a more sloping, almost vertical, appearance of the center (straight) portion of the S-curve in Figure 3.

Whenever speed zones are changed, the collection of speed data several weeks later, at the same location, with the same observers, and under similar traffic conditions, will provide useful after information on changes in speed characteristics.

5.1 EQUIPMENT, CONDITIONS, AND DATA COLLECTION SITES

Speed checks or spot speed studies are usually made by using either a hand held or vehicle mounted radar or laser gun. The radar or laser gun should be positioned on the edge of the roadway at a narrow angle in order to minimize error. Current technology has developed laser speed detection which enhances inconspicuity when conducting these studies. This is an important factor since data collected using radar equipment can be skewed due to the fact that a majority of motorists and truck drivers use radar detectors.

Figure 1
Typical "Bell" Curve or Histogram showing distribution of speed values

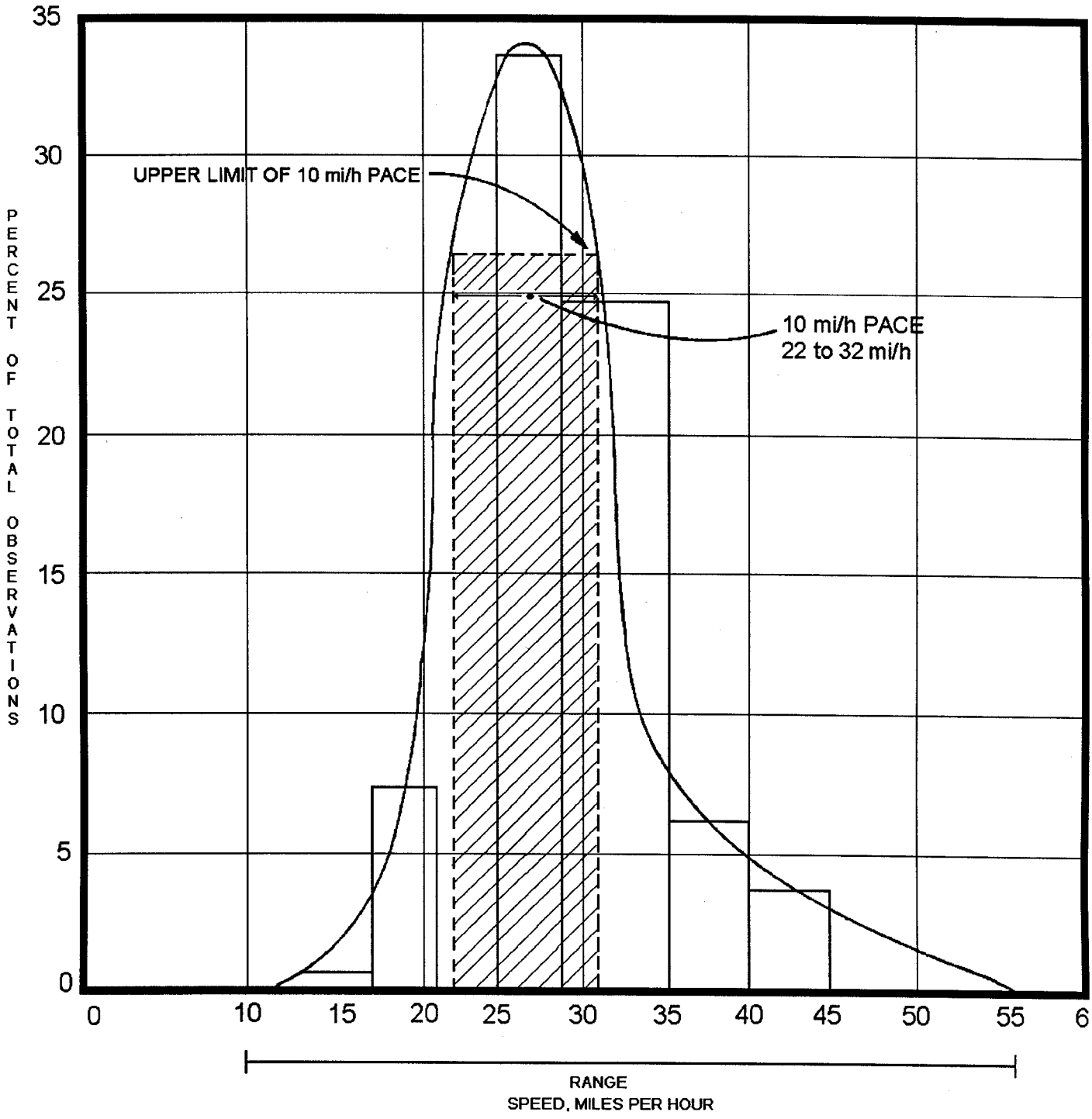
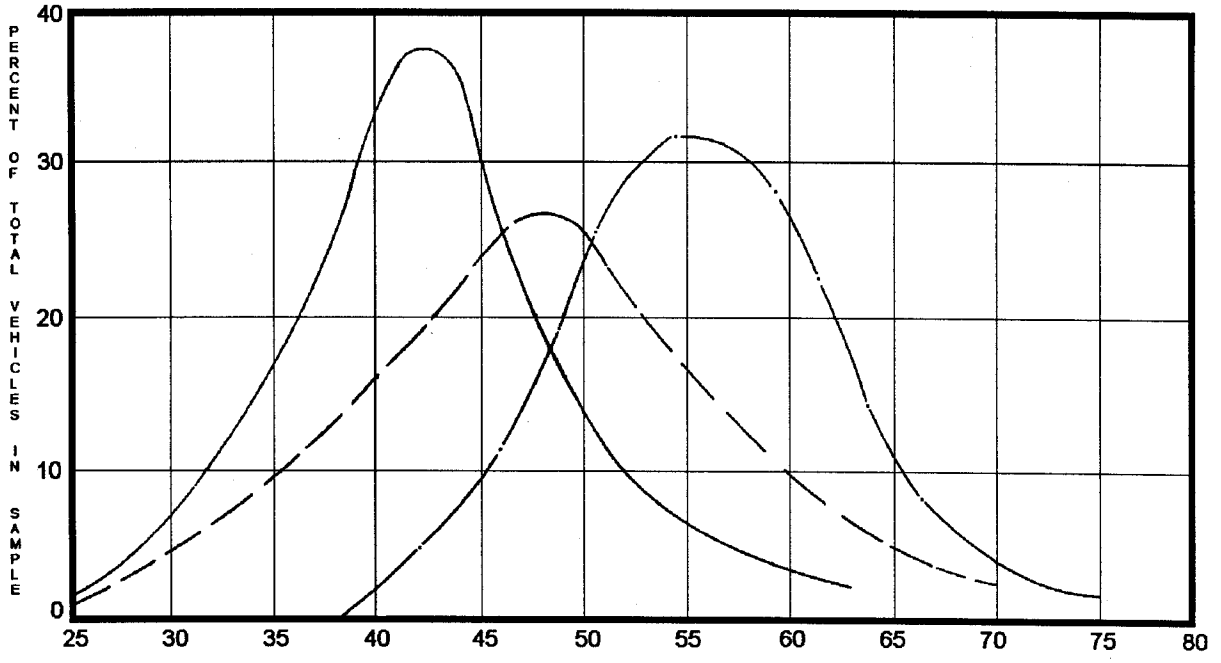
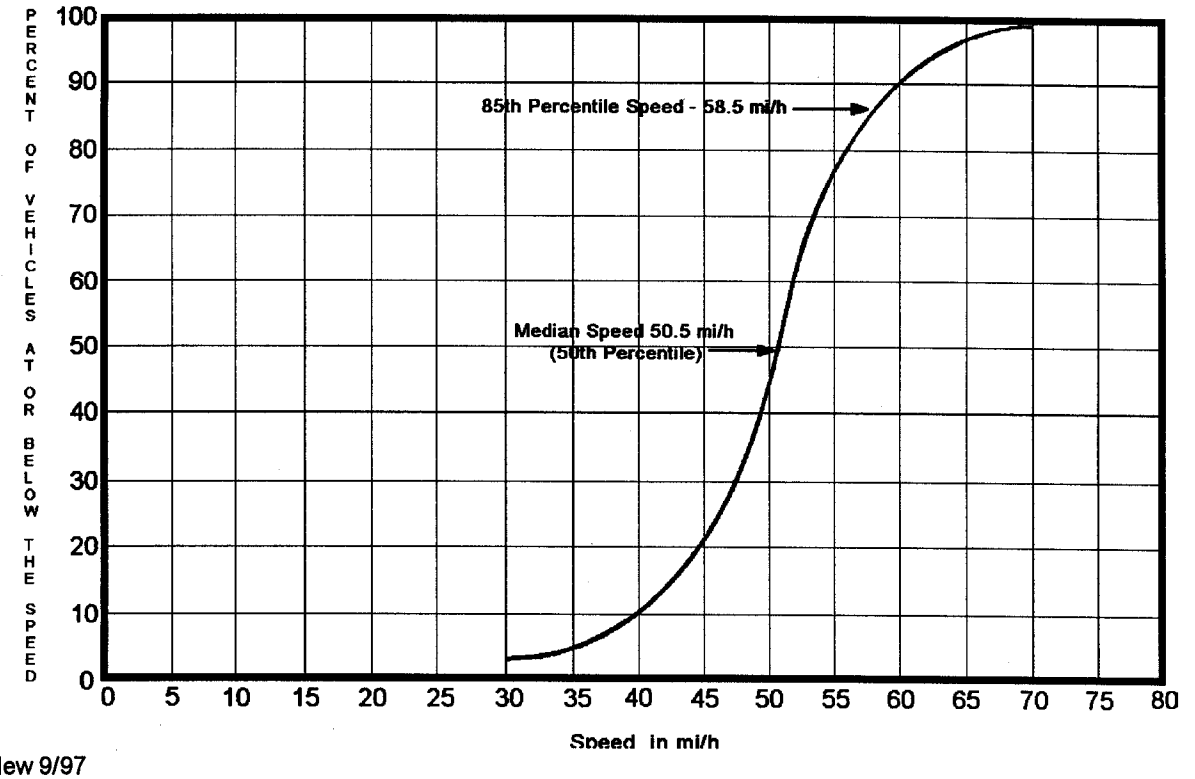


Figure 2
Free-Moving Spot Speed, mi/h



Note: "Bell" curves vary in range, skewness, and position on speed value scale depending upon road, land use, vehicle environment and driver conditions.

Figure 3
Typical "S" Curve or Cumulative Frequency Curve



When using either radar or laser speed detection equipment, the speed checks or spot speed studies should be performed during periods when the pavement is dry to determine the 85th percentile and the upper limit of the 10 mi/h pace.

While the use of round pneumatic road tubes were once considered unacceptable for speed zoning, comparison studies utilizing radar equipment show little disparity in data. In reality, pneumatic tubes are often the least conspicuous method of data collecting and allow long term (24 hours or more) collection which may identify a speed trend not recognized utilizing a spot speed study.

In addition, permanent count stations which have traffic classifiers capable of providing velocity should also be utilized as a reliable source of data collection. These sites are operated by the FDOT's Transportation Statistics Office in Tallahassee (850) 488-4111.

Every effort must be made to disguise or conceal the fact that speeds are being recorded, otherwise distorted data will be collected, the analysis of which can lead to unrealistically low speed limits. A speed survey should be made at times of the day when it is possible to measure free-flowing traffic. Usually, these conditions do not occur during peak traffic hours. An exception would be low volume facilities. The first vehicle in a platoon should be monitored unless all are free-flowing. Free-flowing traffic is defined as a condition when drivers have relative freedom to choose a speed without interference from other traffic.

Variations in recommended setup procedures and equipment sensitivity of different radar meters will require use to determine whether speeds in both directions of traffic can be recorded at the same time. In moderately heavy, but free-flowing traffic conditions, this may not be of concern if a person is kept busy recording one direction only, but often, if equipment accuracy allows, it is not only possible, but saves manpower if both directions can be observed and recorded at the same time from one setup location. Generally, you can observe and record at the same time on a two-lane roadway, but not a four-lane divided and it is marginal on a four-lane undivided roadway.

Although limited in number, overpasses may provide a well-concealed vantage point for measuring speed on divided highways. The equipment is set up or fastened to the handrail or guardrail on the far side of the crossroad bridge and directed at traffic moving away from the bridge rather than toward it. Depending upon bridge design and width, it may be necessary to run the power and meter cables to the end of the bridge to gain concealment. As with any speed measuring set up, it is advisable to make a couple of test runs past the site to establish accuracy.

Radar meters are now available from several sources and it is advisable to check the equipment instructions to determine the recommended angle or angular range between the transmitter axis and the road lanes being observed. Although perhaps not advisable for enforcement purposes (where concealment may not be important), it is possible with

some equipment to exceed the maximum setup angle to get concealment provided that, with test runs, the meter or readout display is adjusted by a factor which may be constant or may vary with the speed. Once this is done, a table can be prepared showing the observed versus actual readings for various angles and can be used from site to site. As with any speed measuring device, the accuracy must be checked periodically.

Please note that with the common use of the intra-vehicular radar detectors and the more common use of CB radio communication, the presence of any radar setup, no matter how well concealed, may quickly be known to enough drivers, whether by their use of such equipment or by the awareness of others slowing down. This results in distorted speed data which could lead to unrealistically low speed limits. Although more time consuming and costly, one way to avoid this is to use CB equipment to monitor drivers' detection of the radar and shut down operation for an interval of time.

Only general guidelines can be given on the subject of speed data collection sites because judgment plays such a large role. Obviously, a semi-rural area with unchanging land use, roadway width and character does not require speed checks at closely spaced intervals and it is not uncommon to space them at 1/2 mile intervals or more as long as sampling is not done in areas where drivers are expected to accelerate or decelerate such as in horizontal curves, steep grades, lane merge, etc.

As the land use urbanizes, traffic volumes increase, roadway character changes, other regulations change (such as curb parking restrictions), or there is a frequency of interchanges or intersections, the need increases for carefully selecting speed check sites sometimes as close as one block intervals. This is done to capture the real changes in conditions which affect drivers' speed, and in turn, through the speed zoning process, provide speed limits that are reasonable.

The proximity to the following types of conditions should be avoided when selecting speed check sites because their effect on drivers will give a distorted or biased speed check:

- Stop Sign
- Railroad Crossing
- Bump or Dip in Roadway
- Narrow Bridge
- Construction activity or other work on or adjacent to the road
- School Crossing
- Traffic Signal
- Congested Traffic
- Steep Grade
- Horizontal Curve
- Poor Sight Distance
- Diverge and Merging Areas

Three particular situations involving the above conditions are sometimes unavoidable and preclude the use of spot speed studies. The following information on two of them may prove helpful when speed zone alterations are contemplated, while a third on curving subdivision streets is addressed in Section 14.1 (Speed Zone Locations).

5.1.1 Non-Interconnected Traffic Signals (Closely Spaced)

Due to the random cycling relationship of signals, there may be times when all signals will be green for a driver, but the infrequency of this makes speed data collection a time-consuming and tedious procedure, and at best of questionable value. Considering the types of streets having traffic signals, it is uncommon to have a speed limit less than the legislative blanket speed of 30 mi/h; however, speed zoning may also result in a higher speed limit.

By their very function, some streets with signals would have an 85th percentile speed well above 30 mi/h if the signals were spaced farther apart and/or had proper equipment and/or had proper timing. Selecting a speed limit for these conditions requires traffic engineering knowledge in understanding the purpose and function of speed zoning in the interest of safety and operations. In some cases, it is desirable to conduct studies during low volume periods to obtain free-flow conditions.

Whenever traffic signals are interconnected on progression, it is advisable to establish a speed limit equal to or higher than the progression speed otherwise drivers may be lured into exceeding the lawful limit.

5.1.2 Stop Sign Control Intersections (Closely Spaced)

As with the above situation, speed checks at closely spaced stop sign control intersections are of little value. It is unfortunate some agencies have a credibility gap with drivers caused by well-intended, but misused traffic signs. Use of realistic speed zones (regulatory) and advisory speeds (warning) as outlined in Section 15.1 (Other Speed Signs and Terms) is an important way to develop proper credibility and respect.

5.1.3 Limited Access Facilities

Factors to be considered when making speed studies on limited access roadways include, roadway characteristics, freeway to freeway splits, rest areas, urban and rural areas and also the proximity of interchanges.

6.1 WHEN TO MAKE STUDIES

In some areas of Florida, there are wide fluctuations in traffic volumes by time periods which may help determine when and when not to make speed checks:

- Hour of day
- Weekdays vs. weekends
- Day of week
- Day vs. night
- Season of year

There is no quicker way to distort the outcome of a legitimate speed zoning study than to gather data in such a manner or at such time that it is not typical of the conditions which

should govern realistic limits. For example, the measured speed of bumper-to-bumper, congested traffic is only a witness to an overburdened road's ability to handle a limited capacity at a low level of service. As the traffic demand lessens, the speed increases up to a point during early morning hours when an isolated driver is seldom influenced by any other vehicles. These are extremes, but care must be taken to measure the free-flowing speed of vehicles whose drivers have a reasonable freedom of choice to travel at a speed predominately dictated, not by other drivers, but by permanent conditions.

Data collection for speed zoning should not occur in the vicinity of intensive enforcement activity or for a few days thereafter. However, data collected before, immediately after, and a week or two later, may provide useful information on effectiveness of the enforcement. Concealment of survey equipment, observers, and vehicles is more critical than usual because of drivers' sensitivity to the enforcement activities.

Two ancillary items relating to the subject may be helpful in understanding speed zoning. They concern day vs. night and seasons.

- Day vs. night - many years ago the practice of setting the night speed 5 mi/h lower than the day speeds was common practice. While this is no longer necessary with improved vehicle capabilities, conditions may exist on individual roadways where this may be a desirable practice. Examples could include in coastal areas where combinations of climate consistently produce nighttime fog.

- Although this manual repeatedly cautions against making speed studies when high traffic volumes preclude a free-flowing condition, there are locations in Florida (particularly beach areas) having hourly volumes during peak seasons at such high levels throughout most of the day that congestion becomes the norm and free-flowing data is only collectable during the early morning hours.

  Two ways to approach this are:

  - Accept the fact that speed limits are a maximum speed for ideal conditions. Collect data during the off peak hours and establish the speed limit in accordance with Section 9.1 (Determining the Speed Limit). This permits a driver to operate a vehicle at higher speeds during non-impacted hours without an unrealistic speed restriction.

  - Provide seasonal speed limits or other time period speed limits such as described in Section 15.1 (Other Speed Signs and Terms). Whether on a seasonal or daily basis, speed signs can be changed in accordance with the regulations legally established.

    For the short time periods, manual, electromechanical, or matrix signs can display speed limits; however, for enforcement and litigation purposes, a record must be maintained on the day, hour and minute a change is made, unless the sign message is changed on a predetermined schedule.

7.1 SPEED CHECK SAMPLE SIZE

The speeds of a minimum of 100 vehicles in each direction or, if traffic volumes are low, all free-flowing vehicles during a two-hour time period, should be recorded on data sheets as shown in the Vehicle Spot Speed Study (Figure 4). For greater variability a larger sample size is required. Various computerized vehicle count programs will prove useful for this study.

For both two and four-lane undivided roads, the speed of vehicles in both directions can be measured with the same equipment setup. If traffic volumes are not too high, both directions can be observed at the same time.

On some low-volume roads and streets, a two-hour study might contain a small number of measured speeds (up to 50 mi/h in both directions). It is with this limited data that:

- the best traffic engineering judgment must be exercised;
- the analyst must be assured the observer, equipment, and vehicle were sufficiently concealed to take a true, uninfluenced sample, and;
- the need determined for test runs to add depth to the limited data, by driving the road not as a technician, analyst, or engineer, but as a typical driver reacting to perceived conditions.

A minimum of three test runs in each direction should be made and, if in an area where one end of the anticipated zone is adjacent to a higher speed zone, a substantially long running start should be given to acclimate the driver to the roadway environment. A short approach run, particularly from a stopped position, does not represent a normal situation.

Measuring speeds by vehicle classification (cars, trucks, buses, etc.), is not necessary unless the specific speed of such vehicles is a concern.

8.1 CALCULATING 85TH PERCENTILE AND OTHER SPEED CHARACTERISTICS

To calculate the 85th percentile speed, multiply the total number of vehicles whose speed has been measured and recorded (sample size) by 0.85 which gives the 85th percentile point in the Cumulative (Cum.) Total column of the Vehicle Spot Speed Study sheet (Figure 4). Next, mark that point between the two cumulative speed numbers where this value falls. If it is one of the numbers, no further calculations are necessary. The 85th percentile speed is the speed in the mi/h column on that line. The lower (bottom value) is the whole number of the 85th percentile speed. The tenths which are to be added to it are found by performing interpolation as shown below.

Figure 4

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION
VEHICLE SPOT SPEED STUDY

FORM 750-010-03
TRAFFIC ENGINEERING
09/97

LOCATION ID: Douglas Rd - C.R. 949	SECTION: —
LOCATION: 137 m. E. of Northfork Cr.	Km P: 46.396 MP: 28.830
POSTED SPEED (mi/h): 55 mi/h	COUNTY: Bedford
DATE: 6.4.96	PAVEMENT CONDITION: Dry
OBSERVER: K. Matthews	TIME FROM: 9:00 AM TIME TO: 11:00 AM
REMARKS: Concealment Quite Difficult	

NUMBER OF VEHICLES E BOUND						SPEED	NUMBER OF VEHICLES ____ BOUND						BOTH DIRECTIONS	
CUM. TOTAL	TOTAL	20	15	10	5	(mi/h)	20	15	10	5	TOTAL	CUM. TOTAL	TOTAL	CUM. TOTAL
						>60								
						60								
						9								
						8								
						7								
						6								
						5								
						4								
104	1				/	3								
						2								
						1								
103	2				//	50								
						9								
101	2				//	8								
						7								
99	2				//	6								
97	4				///	5								
93	1				/	4								
92	5				////	3								
87	4				////	2								
83	8				////	1								
75	10			///	////	40								
65	9			///	////	9								
56	14		////	///	////	8								
42	12		////	///	////	7								
30	9			///	////	6								
21	11			///	////	5								
10	4				////	4								
6	1				/	3								
5	3				///	2								
						1								
2	1				/	30								
						9								
						8								
1	1				/	7								
						6								
						5								
						4								
						3								
						2								
						1								
						20								
						<20								
		TOTALS									TOTALS			

10 mi/h Pace
34 - 43 mi/h
85%tile Point is:
104 × 0.85 = 88.4
85%tile speed is:
42 mi/h

SPEED DATA SUMMARY	E BOUND	____ BOUND	BOTH DIRECTIONS	
85th PERCENTILE SPEED	42			ENGINEER: B. Traffic
10 mi/h PACE	34 ~~~~~ 43	~~~~~		DATE: 7.6.96

8.1.1 Example (using Figure 4)

- Sample Size = 104
  85th percentile point = 104 X 0.85 = 88.4

- This 85th percentile point falls between 42 and 43 mi/h in the Cum. Total column (42 mi/h therefore is the whole number of the 85th percentile speed).

Since the data is collected in whole numbers and the final, posted speed value will be in a 5 mi/h increment, and especially because of the normal variances of data collection, some agencies simply use the 85th percentile speed as that speed nearest the 85th percentile point.

The upper limit of the 10 mi/h pace is determined from the same study sheet. This often can be estimated visually without calculations by looking at the pattern of tally marks. Another way to select this pace, or to verify the visual method, is to scan the data for the highest total number of vehicles within any 10 mi/h range.

In Figure 4, this pace is obvious, and runs from 4 in the 34 mi/h line to 5 in the 43 mi/h line. The upper limit of this 10 mi/h pace is 43 mi/h. The number of vehicles within the 10 mi/h pace is 86 and the percentage of vehicles within the pace is 83 percent.

A blank copy of the Vehicle Spot Speed Study (FDOT Form Number 750-010-03) appears in the Appendix, and it is also available through the OfficeVision Form Library.

9.1 DETERMINING THE SPEED LIMIT

According to Section 2B-10 of the Manual on Uniform Traffic Control Devices (MUTCD), *"The Speed Limit sign shall display the limit established by law, or by regulation, after an engineering and traffic investigation has been made in accordance with established traffic engineering practices. The speed limits shown shall be in multiples of 5 mi/h."*

A speed limit should not differ from the 85th percentile speed or upper limit of the 10 mi/h pace by more than 3 mi/h and it shall not be less than 8 mi/h. A speed limit of 4 to 8 mi/h less than the 85th percentile speed shall be supported by a supplemental investigation which shows:

- there are road or roadside features not readily obvious to the normally prudent driver, such as length of section, alignment, roadway width, surface condition, sight distance, traffic volume, crash experience, maximum comfortable speed in curves, side friction (roadside development), signal progression, design speed, etc. or;

- other standard signs and markings have been tried but found ineffective.

9.1.1 Example

- A measured 85th percentile speed of 42 mi/h would result in a 40 or 45 mi/h speed limit unless supplemental investigation conditions are met. The 40 or 45 mi/h limit then could be lowered 5 mi/h, thus producing a 35 or 40 mi/h speed limit (minimum potential speed limit). The maximum potential speed would be 45 mi/h (unless the upper limit of the 10 mi/h pace were greater than 42).

- Extreme care must be taken to assure that the condition upon which the 5 mi/h reduction is based on is not one which a driver may have taken into account either consciously or subconsciously. Otherwise, it will be given double weight and result in an unrealistically low speed limit.

9.1.2 Traffic Crashes

It is not possible within the scope of this manual to give details on the evaluation and statistical analysis of traffic crash information. Before and after crash studies are a valid means of measuring degrees of success, or failure of any traffic control device or physical change in a transportation facility. However, caution must be exercised or false conclusions can be reached if the magnitude, time span, or actual number of crashes (including personal injuries, deaths, and property damage) is not statistically significant to provide valid conclusions. In addition, crash and fatality rates should be computed to avoid comparison of crash information under different traffic volume conditions, whether it be two different years or months, or simply daytime versus nighttime crashes during the same time period.

Crash experience on a section of road (unless a newly constructed or reconstructed road) should be considered, but the fact that crashes have been known to increase on some roads and decrease on others after a speed limit is lowered, should be kept in mind in applying crash data toward the choice of the numerical speed limit. Generally, a higher number of crashes occur when the speed differential is greatest. Individual speeds at the 85th percentile level is by definition the safest speed to travel.

10.1 SPEED ZONE SIGNS

All speed zone and related signing must be in compliance with requirements set forth in the MUTCD as adopted by the State of Florida (Rule 14-15.010, F.A.C.).

On one-way streets and on divided roads with ample median, placement of a pair of speed signs on the left and right sides of the one-way roadway improves communication with drivers. Dual signs are especially important at locations where the speed limit is lowered.

The speed sign tabulation sheet in Section 16.1 (Speed Zone Establishment and Records) lists only those signs essential to providing information to drivers of the change in numerical speed limits. Unless speed zones are short, additional signs should be

placed to give reaffirming information to drivers, as well as the new information to drivers turning onto the road from a side street.

Concerning speed zone signs, Section 2B-13 of the MUTCD states, *" Speed limit signs, indicating speed limits for which posting is required by law, shall be located at the point of change from one speed limit to another. These signs shall not be erected until the speed limits are approved and officially authorized.*

At the end of the section to which a speed limit applies, a SPEED LIMIT (R2-1) sign showing the next speed limit shall be erected. Additional signs shall be installed beyond major intersections and at other locations where it is necessary to remind motorists of the limit that is applicable. In school areas, the END SCHOOL ZONE (S5-2) sign may be used as an alternate to the SPEED LIMIT sign."

Concerning the REDUCED SPEED AHEAD (R2-5a) sign, Section 2B-14 of the MUTCD states, *"This sign should be used in rural areas to inform the motorist of a reduced speed zone when an advance notice is needed to comply with the speed limit posted ahead. The sign is not ordinarily needed in urban areas where speeds are relatively low.*

This sign shall always be followed by a speed limit sign erected at the beginning of the zone where the altered speed limit applies."

Extreme care must be exercised in placing the additional signs, with emphasis on locations where such reminder signs should not be placed; e.g., in proximity to a horizontal curve, railroad track, school zone, traffic signal, stop sign, narrow bridge, or any other type of roadway characteristic that may overload a driver's ability to process information and react accordingly.

11.1 LENGTH OF GRADUATED SPEED ZONES

A specific speed zone may be only a short segment of a graduated speed zone or may run for many miles without changing.

The State of Florida has no required minimum length for any speed zone, but traffic engineering judgment suggests that zones which are so short that they require a driver to apply his brakes to comply, are not reasonable. Although natural deceleration varies with vehicle type and transmission, a minimum zone length (if the graduation of measured speeds is rather abrupt) should be based on natural deceleration. Some traffic engineers believe zones should have a minimum time length, thus resulting in longer zones in the higher speed ranges. One must judge the trade-off between shorter zones of 5 mi/h increments, and longer zones of 10 mi/h increments. When speed checks show abrupt drops in the 85th percentile speed, the 10 mi/h elements may be the better choice to increase the length of zones. To exceed a 10 mi/h change from one zone to another is poor

practice and violates the purpose of providing smooth transitions in realistic graduated speed restrictions.

Section 11-804(e) of the Uniform Vehicle Code and Model Traffic Ordinance (1992) which was developed by the National Committee on Uniform Traffic Laws and Ordinances, states the following regarding the number of alterations of speed restrictions. *"Not more than six such alterations as herein authorized shall be made per 1.6 kilometer (one mile) along a street or highway, except in the case of reduced limits at intersections, and the difference between adjacent limits shall not be more than 10 miles per hour."*

12.1 AREAWIDE "BLANKET" SPEED RESTRICTIONS

Notwithstanding the declaration in Section 316.006, F.S. that chartered municipalities and counties shall have original jurisdiction over all streets and highways located within their respective boundaries, except state roads.

Section 316.189, F.S. stipulates that alterations from either the 30 mi/h as set forth in that same section for municipal roads and streets, or; the 25 mi/h as set forth in that same section for business and residential districts for county roads and streets and the provisions of Section 316.183, F.S. for other county roads and streets, shall be in conformity to criteria promulgated by the Department of Transportation.

Although Section 316.003, F.S. provides definitions for business and residential districts, the identification of such districts should not be left to driver judgment; rather, speed limit signs should be located at frequent intervals to inform drivers, particularly in areas that marginally meet the requirements in the definitions and where no alteration has been made by speed zoning methods described in this manual.

Although the word municipal denotes urban and, hence slower speed conditions, there are many municipalities which have rural or semi-rural conditions where the speed limit, according to Section 316.189(1), F.S., is 30 mi/h. To alter the speed limit to a realistic level, the methods described in this manual must be used.

Such methods also must be used, according to Section 316.189(2), F.S., to lower the 55 mi/h speed limit on county maintained roads which do not meet business or residential land use requirements, yet are not rural in nature.

Section 316.003, F.S. defines Business and Residence as follows:

- Section 316.003(4), F.S., Business District: *"The territory contiguous to, and including, a highway when 50 percent or more of the frontage thereon, for a distance of 300 feet or more, is occupied by buildings in use for business."*

- Section 316.003(38), F.S., Residence District: *"The territory contiguous to, and including, a highway, not comprising a business district, when the property on such*

highway, for a distance of 300 feet or more, is, in the main, improved with residences or residences and buildings in use for business."

This manual sets forth the DOT criteria to establish specific speed zones and in no way provides a means whereby a blanket speed limit, such as 25 mi/h, can be enacted by local ordinance (often with signs placed at city limits declaring, 25 MPH, UNLESS POSTED). To do so is contrary to the intent of the statutory 30 mi/h Blanket Speed Limit, which only can be altered upward or downward on a location basis by the traffic engineering procedures described herein.

13.1 UNIFORM SPEED ZONING AND ENFORCEMENT

The quest for uniform traffic control devices (signs, signals and markings) has been underway for more than 50 years in this country. Progress is on-going due to an excellent working relationship between the department and the Federal Highway Administration.

Uniform control *devices* do not bring uniform traffic *control* unless uniform *enforcement* and uniform traffic *laws and ordinances* are perceived to be reasonable when applied to these devices and to driver performance. We are fortunate that the State of Florida ranks very high in compliance to the Uniform Vehicle Code and the Model Traffic Ordinance developed by the National Committee on Uniform Traffic Laws and Ordinances.

Developing uniform speed zoning methods throughout all of Florida's local jurisdictions would be of questionable value if the *enforcement* of these and other restrictions was not applied uniformly.

While speed enforcement tolerances are rightfully the authority of law enforcement agencies and not traffic engineering, we are hopeful this activity is openly discussed and is a subject of concern for uniformity among law enforcement agencies statewide. If not, we may develop the best possible system of speed zoning but not achieve uniform traffic control. Furthermore, the tolerances an enforcement agency expects to apply to speed zones must not affect the process of selecting the numbered speed zone, otherwise uniformity will not result.

The primary purpose of speed zoning is not intended to be a revenue producing program, contrary to the belief of some drivers and (unfortunately) to a few local jurisdictions.

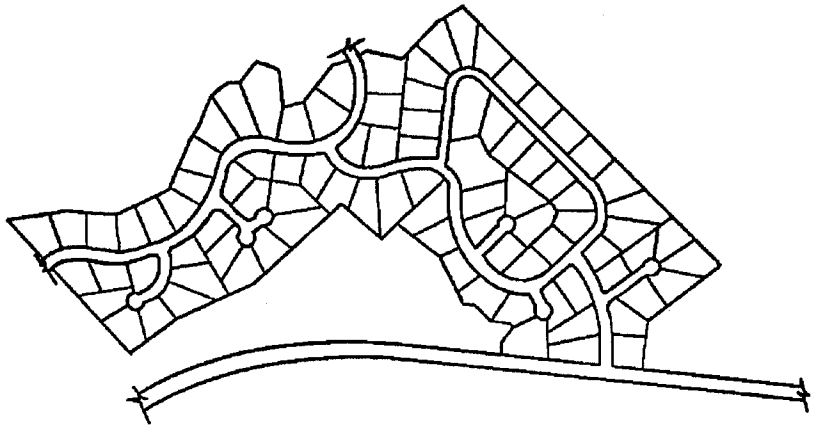
The Department of Transportation encourages *uniform speed signs, uniform development of numerical speed limits, and uniform practice of enforcement* with the multiple objectives of better highway safety, higher respect for traffic control devices and laws, improved credibility between enforcement and engineering agencies with the driver, and ultimately the ability to actually influence vehicle speed when we wish to bring about a reduction because of a condition ahead not readily evident to the driver.

14.1 SPEED ZONE LOCATIONS

14.1.1 Subdivision Streets

Street systems in some subdivisions are like the grid patterns common to urban areas, but many new subdivisions are designed with streets that provide almost continuous horizontal curvature. In addition to their aesthetics, such winding streets discourage both higher driving speeds and through traffic. A typical subdivision street pattern is illustrated in Figure 5.

Figure 5



Depending upon the design speed of the curves and any superelevation that is provided, the posting of signs with the blanket speed limit of 30 mi/h as provided in Section 316.189, F.S., may be inappropriate except on tangent sections of roadways of such length that drivers would not be influenced by alignment curvature. This could actually be negative in some left curves on roads depending upon crown or sheet flow (drainage) cross section design. Section 5.1 (Equipment, Conditions, and Data Collection Sites) cautions against making speed checks within horizontal curves and Section 15.1 (Other Speed Signs and Terms) refers to a method of arriving at an advisory speed for posting at horizontal curves. For continuous or near continuous curving roads of subdivision streets, the use of speed checks (through data collection and computation of the 85th percentile speed) is inappropriate for determining the posted speed. (Two other situations in which speed data also may be inappropriate are discussed in Section 5.1).

If a subdivision is not completed, an engineering decision can be made on an appropriate posted speed based on anticipated driving speeds on winding, curving street patterns.

If the subdivision streets are completed, the third type of basic traffic investigation listed in Section 4.1 (Traffic Engineering Investigations) would apply. Test run speeds are used

in lieu of data from the measured speed of many vehicles in order to arrive at a realistic speed limit.

- Except in rare cases, drivers' choice of speed is based on many factors, as outlined in Section 3.1 (Driver Behavior) of which speed signs are only one, and often a minor one.

- For speed limits to be of traffic safety value, they must be realistic and acceptable to most drivers. Use of realistic speed limits still results in 10 to 20 percent violation rate which is as much as enforcement personnel can handle.

- Use of unrealistically low speed limits usually results in high violation rates which negates speed zoning.

- High violation rates far exceed a practical citation rate unless a mass, concentrated enforcement effort is applied, usually without measurable residual effect.

- Design speed has the greatest impact on actual operating speed in and adjacent to horizontal curves, where the driver/vehicle/roadway relationship dramatically affects the driver (physically) by centrifugal force.

14.1.2 Design Speed

On subdivision streets where adjacent development is anticipated within a reasonable time, design decisions should be based on traffic speed expected to occur from such development (residential home construction). Such design decisions would include cross section, degree of curvature, superelevation (if any), treatment of fixed objects, and/or tree removal.

An engineer cannot assume that a residential land use with a well designed road, particularly a main road fed by a network of other streets and/or carrying traffic through the subdivision, will operate at 30 mi/h. It is not uncommon for such streets to become semi-arterial and posted with 25 or 30 mi/h signs plus one of the many versions of non-authorized CHILDREN PLAYING or PLAYGROUND (W15-1) signs which have no measurable benefits on traffic and may even have a negative safety effect by appeasing residents' concern about safety for children.

Traffic safety would be improved if residential lots on such roads had substantial building setbacks to lessen the likelihood of; (1) children playing in the streets, and (2) residents' vehicles being parked on or parallel to the street.

14.1.3 Drag Racing

When traffic volumes are light and there is no roadside development or activity, it is not uncommon for racing to occur. The location could be a tangent section of a rural highway

as well as a subdivision street, wherever detection and apprehension are unlikely to interrupt the activity. As a subdivision expands, the racing just moves to other locations.

14.1.4 State Parks

The street system within State Parks presents a unique situation of determining the appropriate speed to be posted. State Park roadways are intended for leisurely driving and recreation, contrary to the purpose of all other highways.

Section 316.187(2)(c), F.S. authorizes the Department of Transportation to set maximum and minimum speed limits on roadways under its' authority as it deems safe and advisable (not to exceed a maximum limit of 60 mi/h). Since the intent of State Parks roadways is to produce an attitude of relaxation and leisure, the posted speed limit shall be 25 mi/h.

However, at more congested centers and near park buildings, beaches, picnic, campground and play areas, the appropriate posted speed limit is 15 mi/h. These speeds, 15 and 25 mi/h, are based on engineering judgment due to the types of activities that are expected within their respective zones. An engineering and traffic investigation is still necessary in order to determine the limits of each speed zone. Speed limits within State Parks, other than 15 or 25 mi/h, shall not be posted unless and until such speed is deemed appropriate on the basis of an engineering study.

14.1.5 Work Zones

The goal of traffic control for construction, maintenance, and utility operations work zones, is to route traffic through such areas in a manner as closely comparable to normal highway conditions as possible. As noted in Section 6G-10 in Part VI of the MUTCD, *"For these operations there must be adequate legislative authority for the implementation and enforcement of needed traffic regulations, parking controls, and speed zoning. Such statutes should provide sufficient flexibility in the application of traffic control to meet the needs of the changing conditions in incident areas."*

Florida Statutes require a traffic control plan which shows the appropriate regulatory speed signs for each contract let by the department and exempts the establishment of work zone regulatory speeds from the 14-day advance notification. This requirement is consistent with the department's efforts to improve work zone traffic control and safety.

Regulatory speed establishment or change must be made on the basis of an engineering and traffic investigation as required by Section 316.187, F.S. Preparing and documenting the engineering and traffic investigation for work zones is significantly different than for the establishment of normal regulatory speeds. This is due to the changing nature of work zones and that it is neither appropriate nor feasible to establish regulatory speeds in work zones based on the 85th percentile criteria. Regulatory speeds through work zones must be established on existing or anticipated field conditions using engineering judgment. The

field conditions that should be considered are: traffic volumes, congestion, construction phasing, lane restrictions, type of construction, closeness of traffic to workers, use of concrete barriers, equipment, flagger usage, pedestrians, geometrics, and physical conditions. Other conditions may need to be addressed on a project by project basis. All of the conditions do not have to be addressed in each individual investigation, only those that contribute to the justification for revising the existing regulatory speed.

The design engineer of record's engineering and traffic investigation will consist of the project file and the traffic control plan as included in the project plans. The documentation will be these same items. If the field engineer recommends a change in the regulatory speed after the project has been started, the engineering and traffic investigation and documentation will consist of a report signed and sealed by the appropriate professional engineer, addressing the conditions that require a change in the existing regulatory speed.

Regulatory speed signs should be used on all construction, maintenance, and utility operations, whenever practical, in lieu of advisory speed plates. There may be circumstances when advisory speeds are posted until such time as regulatory speeds can be justified and installed. Such circumstances may include emergencies where maintenance must respond immediately or unforeseen conditions in a construction work zone exist which warrant speed reduction.

Generally, speed should not be reduced more than 10 mi/h below the posted regulatory speed except in emergency situations or extremely unusual conditions. When reductions exceed 10 mi/h, the reduction should be accomplished in 10 mi/h increments. When establishing the appropriate regulatory speed for each phase of maintenance of traffic, the engineer should generally establish one speed for the entire phase and avoid instances that would require multiple changes of regulatory speeds within each phase.

The engineer should also consider the guidelines included in the department's Plans Preparation Manual when determining the need for speed restrictions.

In no case, should the speed limit be reduced below the minimum regulatory speed established by Florida Statute for that class of facility.

14.1.6 Rest Areas

Ramp exit speeds, including those leading into rest areas, are discussed in Section 2C-36 of the MUTCD. However, the appropriate regulatory speed limits within the rest area itself is not mentioned.

Determining speed limits in the rest area through traffic observation studies is generally not feasible. Since there are numerous parking maneuvers and uncontrolled pedestrian movements, the engineer's experience and judgment will play an important part in establishing a reasonably safe speed limit through this area.

Speeds of 15 mi/h for congested portions of the rest area and 25 mi/h in the other portions are generally appropriate. An engineering and traffic investigation will indicate the limits of these speeds and/or lead to the determination of a more appropriate speed(s).

14.1.7 Environmentally Sensitive Areas

Coordination will be required between District Traffic Operations and the District Environmental Management Office when speed limits are to be established or increased on facilities which pass through, or are adjacent to, public lands being managed for wildlife values.

Coordination shall include, but not be limited to, (1) a joint evaluation of the history of transportation related wildlife mortality along the proposed area, when needed; (2) updated statewide maps and/or lists which show environmentally sensitive areas.

It will be the responsibility of the applicable FDOT District Environmental Office to coordinate with the Office of Environmental Services of the Florida Game and Fresh Water Fish Commission (GFC) and any other local, state, or federal agency having management responsibilities over the adjacent land. Lands to be considered as those "managed for wildlife values" shall be all state and federal wildlife refuges, management areas, forests, and parks and lands owned by the water management districts. Also included shall be those privately owned lands which have been previously identified by the GFC as areas of a high incidence of transportation related wildlife mortality.

15.1 OTHER SPEED SIGNS AND TERMS

In addition to the speed zoning procedures discussed in this manual, there are several other commonly used speed signs with which the reader should be familiar. They fall into three main categories; *Time Period Speed (Regulatory), Advisory Speed (Warning), and; Road or Bridge Special Temporary Speed Restrictions (Regulatory).*

15.1.1 Time Period Speed (Regulatory)

Most commonly used as school zones, a special lowered speed limit during specific time periods is based on considerations other than the 85th percentile speed. The speed limit selection decision depends on such things as;

- Age of children,
- Normal approach speed of traffic,
- Sight distance,
- Number of vehicles,
- Width of street,
- Presence of other traffic control devices,
- Use of adult and/or school children crossing guards, etc.

Hours can be posted during which the speed limit applies or a manual control or a time-clock can be used in conjunction with variable message and/or when flashing signs (with yellow beacons). These signs are described in Part VII of the MUTCD, and are referred to in Section 316.1895, F.S.

15.1.2 Advisory Speed (Warning)

Advisory speed signs are warning signs and display recommended maximum comfortable and safe speed rather than the maximum legal speed as displayed on regulatory signs used for speed zoning. Hence, their color is yellow and black (orange and black for work site application) rather than white and black. The MUTCD illustrates two types of these signs in Sections 2C-35 and 2C-36.

- The ADVISORY SPEED (W13-1) plate is a supplemental square sign which *"...shall not be used in conjunction with any sign other than a warning sign, nor shall it be used alone".* The MUTCD further states *"Except in emergencies, or at construction or maintenance sites, where the situation calling for an advisory speed is temporary, an Advisory Speed plate shall not be erected until the recommended speed has been determined by accepted traffic engineering procedures."* Concerning temporary speed signs the MUTCD also states: *"Warning signs with advisory speed limits should be posted at those locations where the safe speed is lower than the normal legal limit. At selected locations, reduced legal maximum limits may be established as provided by statute and posted accordingly."*

- The ADVISORY EXIT SPEED (WI3-2 and WI3-3) signs are rectangular signs which are used alone prior to and/or on expressway and freeway ramps, and like the ADVISORY SPEED (W13-1) plate, are intended for use where engineering investigations show the need of advising drivers of the recommended maximum comfortable and safe speed.

  ADVISORY SPEED signs are not meant to show a speed beyond which a vehicle will spin out (if on a horizontal curve) or bottom out (if used for a dip or hump in the roadway). Rather, they allow for a comfortable margin of safety because of variations in vehicle and pavement characteristics.

It has been said countless times that drivers lack faith in the numerical values on horizontal curve speed signs. This is understandable because of the common misunderstanding by many drivers (and some persons responsible for their installation) of their purpose and meaning. As with realistic speed limit signs, advisory speed warning signs can gain driver confidence and credibility and become effective tools only when uniformly used to communicate important information in the interest of traffic safety.

Advisory speed warning signs are not to be used as enforceable speeds, although a violation of them is sometimes used by enforcement officers in support of other traffic violation charges.

The displayed advisory warning speed:

- Is approximately 75 percent of the maximum safe speed for an average passenger car;
- Is the speed at which driver discomfort begins;
- Is the speed beyond which loose items may shift in a vehicle;
- Is based an average passenger car, typically loaded;
- May be too high for a top-heavy truck;
- May be too low for a sports car;
- May not be too low with loose gravel, sand, or ice on the road.

A special type of spot speed study is conducted to determine the maximum speed at which a horizontal curve can comfortably be driven. The equipment includes a driver, and a test car with ball bank indicator. For more detail on the study techniques, consult Chapter 13 (Vehicle Spot Speed Study) of the Manual on Uniform Traffic Studies (MUTS). The MUTS Manual is available through FDOT's Maps and Publications Sales Office, 605 Suwannee Street, M.S. 12, Tallahassee, Florida 32399-0450, (850) 414-4050.

For information on availability of equipment and more detail on study techniques for advisory speeds, you may contact one of the Department of Transportation district offices listed in the Appendix.

Advisory speed signs used to supplement warning signs such as DIP (W8-2), BUMP (W8-1), HUMPBACK BRIDGE, etc. are based on test runs using an average passenger car and traffic engineering judgment.

This test run method, rather than, or in addition to the ball-bank indicator, also is applicable to some curving ramps which are not simple circular curves, but compound curves (two or more connecting curves of differing radii) or broken back curve (two or more consecutive curves with short tangents between them).

The need for advanced mainline signing of advisory ramp or exit speeds increases proportionately to the difference between the mainline speed and the advisory speed. The greater the difference, the greater the need for more advance signing. Section 2E-8 of the MUTCD cautions that mainline warning (or regulatory) signs when placed on an overhead sign structure or on its support, must be considered as one of the maximum of three signs which can be displayed. Lack of space should seldom be a problem if the sign spreading concept shown in Section 2E-31 of the MUTCD, is followed for the exit direction sign location, particularly since the advisory speed information is directed to the exiting driver.

Advisory Exit speed signs are not recommended for typical diamond interchange ramps. Signs on these straighter, higher speed ramps should be STOP AHEAD (W3-1) or SIGNAL AHEAD (W3-3), whichever is appropriate.

15.1.3 Road or Bridge Special Speed Restrictions (Regulation)

Because of natural or unnatural deterioration or damage to a road pavement, subgrade, or bridge structure, it may be necessary to reduce the speed limit and/or vehicle load limit until reconstruction/repair work can be accomplished. Usually, the speed reduction would apply to heavier vehicles, but in the interest of public safety, as well as minimizing further road or bridge damage, a regulatory speed for passenger cars also may be necessary.

The engineering choice of speed limits for this purpose is not addressed by this manual, but the procedures for locating signs, identifying the zones, etc., is covered.

16.1 SPEED ZONE ESTABLISHMENT AND RECORDS

Although Florida Statutes prescribe certain procedures to gain official approval on speed zone alterations on the State Highway System, once the studies and recommendations have been made, such procedures are not prescribed for county and city roads and streets.

Section 335.10, F.S. as amended, requires the department to prescribe regulations (including speed zones) for vehicles operating on the State Highway System. The department's Topic Number 750-010-011, Traffic Regulation Approval Process complies with this statutory requirement. Notice of speed zoning changes are provided in writing by certified mail, return receipt requested, to each local governmental entity, where such regulation will apply, at least 14 days prior to implementation. Formal documentation of such notices is maintained in the department's district offices.

Any speed zone alteration on county and city roads or streets should be approved by action of a council or commission and entered into the records for that body, unless that agency authorizes and delegates an office or person (by title) to determine and maintain a record system on speed zoning as determined by that office or person in accordance with the methods outlined in this manual.

Records should contain the speed data, the numerical limits, the date approved, the dates of sign installations, and the physical location of the beginning and ending points of each numerical segment. An example of these records is shown in Figure 6.

It is inadvisable to change from one numerical speed zone to another within an intersection such as, 35 mi/h, from Randolph Street to Main Street, because this leaves doubt as to the speed limit within the intersections where crashes are most likely to occur.

When an agency has a coordinate, node, kilometer point, milepost or stationing system, a dual system of zone description provides the most reliable record as shown in Figures 6, 7, 8, and 9. However, if such a system is not available, specific physical descriptions of the speed zones are adequate.

The following discussion is an example that is illustrated in Figure 6. Between June and August of 1964, speed zones were established on the main street (Douglas Road) through a town called Brockway and restudied 12 years later. This facility is a county road extending from the open-speed rural area to the city limits, where it becomes a city street. As a non-state road, it is recognized there will unlikely be an inventory map with kilometer points (mileposts), such as a FDOT Straight Line Diagram which show a great amount of detail for all state maintained roads.

It may seem excessively precise to carry kilometer point and milepost values to three decimal places, but each 0.001 kilometer is one meter, and each 0.001 mile is 5.28 feet. Descriptions of sign locations sometimes require even more than one meter or 5.28 feet accuracy, such as a sign to be located on a lot line between two residences or in a critical location to avoid driveways, other signs and obstructions which might block it from view. So even with milepost and/or node systems, a specific physical description may be important.

Changes in street characteristics and adjacent land use conditions commonly require a re-examination of speed limits. Although the most common numerical change is downward (assuming the existing limits are realistically established by the methods outlined in this manual), it is not uncommon for a speed limit to rise, particularly when major construction changes to the roadway and improvements to traffic control devices (signs, signals, lighting, and markings) cause traffic operational efficiency and safety to increase.

The 85th percentile speed normally decreases as land use intensifies and in the example on Douglas Road, this is what happened on the east side of the town of Brockway between 1964 and 1976. The 85th percentile speed checks at kilometer points 51.784 and 52.790 (mileposts 32.177 and 32.802) indicate drivers reaction to the situation and give justification to altering the speed limits as shown on the bottom line of Figure 6. Please note the official approval by the two jurisdictions and the reaffirmation of the west side zones (the latter action is optional, but updates the records and shows more current validity of the speed restrictions established in 1964). Another line on Figure 6 could show the location and date of installation of the new speed signs on the east side of town.

The location of several traffic signals in the business district preclude the collection of meaningful speed data as discussed in Section 5.1 (Equipment, Conditions, and Data Collection Sites). Therefore, in the absence of any significant changes in this area or of any increase in crashes where speed was a contributing factor, and the fact that 30 mi/h is the blanket speed, according to Section 316.183, F.S. the 30 mi/h zone remained unchanged.

16.1.1 Record Keeping and Continuity

Officials are sometimes asked to provide records showing the official approval of speed zone alterations in litigation proceedings on some traffic crash or speed citation cases.

Litigants may ask for the date the signs were put up, along with work order completion forms signed by the person doing the sign installation, or his supervisor. Maintaining such detailed records as this may seem unnecessary, but if done on a routine basis, is not difficult nor time consuming. Such records provide more accurate evidence in court for proper adjudication of traffic crash and speed citation cases.

Another independent or supplemental record system which some jurisdictions find useful is a speed zone map, similar to a crash spot map. It can be marked with colored pens or tape to show different speed values. Any color system adopted will soon provide glance recognition for frequent users.

It would seem obvious that a speed zone once begun must end and, unless the road ends, must co-terminate with another speed zone. It is not uncommon on rural roads to find a realistic speed becomes unrealistic, simply because it isn't explicitly terminated. Without any additional speed signs for miles beyond, this practice must puzzle both drivers and enforcement officers.

Care also must be exercised to assure a speed zone does not change simply because the road or street enters another agency's jurisdiction. Coordination of speed zoning between the two agencies and use of the methodology in this manual will provide the highest degree of uniformity and safety.

Figure 6

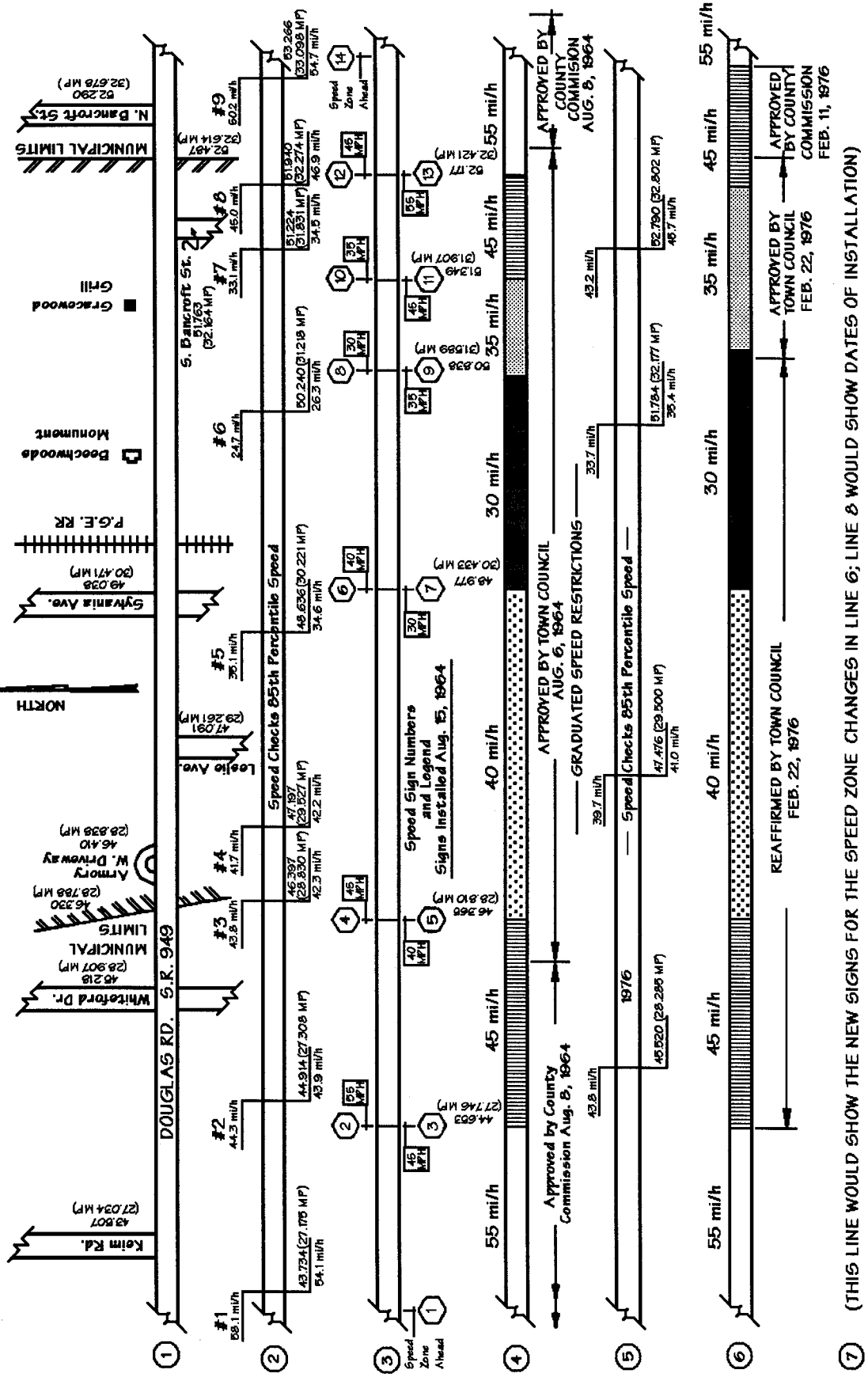

DOUGLAS RD. S.R. 949
Kelm Rd.
43.807 (27.034 MP)
Whiteford Dr.
46.218 (28.707 MP)
MUNICIPAL LIMITS
46.330 (28.788 MP)
Armory
W. Driveway
46.410 (28.838 MP)
NORTH
Leslie Ave.
47.091 (29.261 MP)
Sylvania Ave.
49.028 (30.471 MP)
F.G.E. RR
Beechwoods Monument
Gracewood Grill
S. Bancroft St.
51.763 (32.164 MP)
MUNICIPAL LIMITS
N. Bancroft St.
52.290 (32.676 MP)
#1 58.1 mi/h
#2 44.3 mi/h
#3 43.8 mi/h
#4 41.7 mi/h
#5 36.1 mi/h
#6 24.7 mi/h
#7 33.1 mi/h
#8 46.0 mi/h
#9 60.2 mi/h
43.734 (27.175 MP) 54.1 mi/h
44.914 (27.908 MP) 43.9 mi/h
46.397 (28.830 MP) 42.3 mi/h
47.197 (29.327 MP) 42.2 mi/h
48.636 (30.221 MP) 34.6 mi/h
50.240 (31.218 MP) 26.3 mi/h
51.224 (31.831 MP) 34.5 mi/h
51.940 (32.274 MP) 46.9 mi/h
63.266 (33.098 MP) 64.7 mi/h
Speed Checks 85th Percentile Speed
Speed Sign Numbers and Legend Signs Installed Aug. 15, 1964
APPROVED BY TOWN COUNCIL AUG. 6, 1964
GRADUATED SPEED RESTRICTIONS
APPROVED BY COUNTY COMMISSION AUG. 8, 1964
Approved by County Commission Aug. 8, 1964
1976 Speed Checks 85th Percentile Speed
REAFFIRMED BY TOWN COUNCIL FEB. 22, 1976
APPROVED BY TOWN COUNCIL FEB. 22, 1976
APPROVED BY COUNTY COMMISSION FEB. 11, 1976
(THIS LINE WOULD SHOW THE NEW SIGNS FOR THE SPEED ZONE CHANGES IN LINE 6; LINE 8 WOULD SHOW DATES OF INSTALLATION)
55 mi/h
45 mi/h
40 mi/h
35 mi/h
30 mi/h
Speed Zone Ahead
45 MPH
55 MPH
40 MPH
35 MPH
30 MPH
(27.746 MP)
(28.810 MP)
(29.500 MP)
(30.433 MP)
(31.589 MP)
(31.907 MP)
(32.421 MP)
45.520 (28.285 MP)
46.563
47.476 (29.500 MP)
48.977
50.838
51.349
52.177
52.790 (32.802 MP)
51.784 (32.177 MP)
39.7 mi/h
43.8 mi/h
43.2 mi/h
33.7 mi/h
41.0 mi/h
39.4 mi/h
45.7 mi/h

Figure 7

Speed Checks					
Douglas Road, C.R. 949 Town of Brockway, Bedford County					
Speed Check	Direct.	85%tile (mi/h)	Date of Study	Kilometer Point (mp)	Physical Location
1	EB WB	54.1 56.3	6/22/94	43.734 (27.175)	229 m (750') E. of Keim Road
2	EB WB	43.9 44.3	6/22/94	44.914 (27.908)	305 m (100') W. of Whiteford Road
3	EB WB	42.3 43.8	6/22/94	46.397 (28.830)	68 m (222') E. of North Fork Creek (W. Municipal Limits)
4	EB WB	42.2 41.2	6/22/94	47.197 (29.327)	107 m (350') E. of Leslie Avenue
5	EB WB	34.6 35.1	6/22/94	48.636 (30.221)	402 m (1320') W. of Sylvania
6	EB WB	25.3 24.7	6/22/94	50.240 (31.218)	Directly in front of Police Station
7	EB WB	34.5 33.1	6/22/94	51.227 (31.831)	Between Grace Lutheran and First Baptist Churches
8	EB WB	46.9 45.0	6/24/94	51.940 (32.274)	In front of Yorktown Motel
9	EB WB	54.7 50.2	6/24/94	53.266 (33.098)	Immediately East of Main Entrance to Irish Hills Subdivision

Figure 8

Speed Zones on Douglas Road (C.R. 949)			
Speed Restriction (mi/h)	From Kilometer Point (MP) and/or Physical Location	To Kilometer Point (MP) and/or Physical Location	Zone Length Kilometers (Miles)
55	Open Highway Condition	44.653 (27.746) 1853' W. of Whiteford Rd.	--
45	44.653 (27.746) 1853' W. of Whiteford Rd.	46.365 (28.810) 150' W. of the W. Driveway to National Guard Amory	1.712 km (1.064)
40	46.365 (28.810) 150' W. of W. Driveway to National Guard Armory	48.977 (30.433) 200' W. of Sylvania Ave.	2.612 km (1.623)
30 Through the business area of the Town of Brockway	48.977 (30.433) 200' West of Sylvania Ave.	50.838 (31.589) 275' E. of the Beechwoods Monument	1.861 km (1.156)
35	50.838 (31.589) 275' E. of Beechwoods Monument	51.349 (31.907) 125' E. of the Driveway to Gracewood Grill Restaurant	0.511km (0.318)
45	51.349 (31.907) 125' E. of the Driveway to Gracewood	52.177 (32.421) Midway between N. Bancroft St. and S. Bancroft St.	0.828 km (0.514)
55	52.177 (32.421) Midway between N. Bancroft St. and S. Bancroft St.	Open Highway Condition	--
		Total Distance Speed Zoned	7.524 km (4.675 miles)

Figure 9

Speed Sign Tabulation					
Sign No.	Kilometer Point	(MP)	Sign Legend	Direction of Traffic Facing Sign	Physical Location
1	*	*	REDUCED SPEED AHEAD	EB	*
2	44.653	27.746	55	WB	565 m (1853') W. of Whiteford Rd.
3	44.653	27.746	45	EB	565 m (1853') W. of Whiteford Rd.
4	46.365	28.810	45	WB	46 m (150') W. of W. Driveway to National Guard Armory
5	46.365	28.810	40	EB	46 m (150') W. of W. Driveway to National Guard Armory
6	48.977	30.433	40	WB	61 m (200') W. of Sylvania Ave.
7	48.977	30.433	30	EB	61 m (200') W. of Sylvania Ave.
8	50.838	31.589	30	WB	84 m (275') E. of the Beechwoods Monument
9	51.349	31.589	35	EB	84 m (275') E. of the Beechwoods Monument
10	51.349	31.907	35	WB	38 m (125') East of Gracewood Grill Restaurant Driveway
11	51.349	31.907	45	EB	38 m (125') East of Gracewood Grill Restaurant Driveway
12	52.177	32.421	45	WB	Midway between N. Bancroft St. and S. Bancroft St.
13	52.177	32.421	55	EB	Midway between N. Bancroft St. and S. Bancroft St.
14	*	*	REDUCED SPEED AHEAD	WB	*

* Locate these two signs at a sufficient distance from the No. 3 and No. 12 Speed Signs so that natural deceleration will slow a vehicle from 55 to 45 mi/h. The exact location is not critical, but can be added to the 2nd and 4th columns.

NOTE: Additional columns can be provided for field crews to indicate date (and time) sign was installed.

APPENDIX

FLORIDA DEPARTMENT OF TRANSPORTATION

For further information regarding speed zoning techniques, procedures and field sheets, please contact a representative of the FDOT Traffic Operations Office in the appropriate district or in the central office.

Listed below are the central and district office addresses, phone numbers and the counties assigned to each district.

OFFICE	COUNTY		
State Traffic Operations Engineer 605 Suwannee Street, M.S. 36 Tallahassee, FL 32399-0450 (850) 488-4284	All		
District One Traffic Operations Engineer 801 North Broadway Street Bartow, FL 33830 (813) 533-8161	Charlotte Collier De Soto Glades	Hardee Hendry Highlands Lee	Manatee Okeechobee Polk Sarasota
District Two Traffic Operations Engineer 1901 South Marion Street Lake City, FL 32055 (904) 758-3300	Alachua Baker Bradford Clay Columbia Dixie	Duval Gilchrist Hamilton Lafayette Levy Madison	Nassau Putnam St. Johns Suwannee Taylor Union
District Three Traffic Operations Engineer U.S. Highway 90 East Chipley, FL 32428 (850) 638-0250	Bay Calhoun Escambia Franklin Gadsden	Gulf Holmes Jackson Jefferson Leon	Liberty Okaloosa Santa Rosa Wakulla Walton Washingon
District Four Traffic Operations Engineer 3400 W. Commercial Boulevard Ft. Lauderdale, FL 33309 (305) 486-1400	Broward Indian River	Martin Palm Beach	St. Lucie

District Five Traffic Operations Engineer 719 South Woodland Boulevard DeLand, FL 32720 (904) 943-5000	Brevard Flagler Lake	Marion Orange Osceola	Seminole Sumter Volusia
District Six Traffic Operations Engineer 1000 N.W. 111th Avenue Miami, FL 33172 (305) 470-5100	Dade	Monroe	
District Seven Traffic Operations Engineer 11201 N. Malcolm McKinley Drive Tampa, FL 33612 (813) 975-6000	Citrus Hernando	Hillsborough Pasco	Pinellas
Turnpike Dist. Traffic Operations Engineer P.O. Box 9828 Ft. Lauderdale, FL 33310-9828 (954) 975-4855 Ext. 1293	Florida Turnpike M.P. 0 to M.P. 309 Seminole County M.P. 38 (Aloma Ave.) to M.P. 50 (U.S. 17/92) Beeline Expressway M.P. 0 to M.P. 8.5 Sawgrass Expressway M.P. 0 to M.P. 22 Veterans Expressway Highway M.P. 0 (S.R. 60) to M.P. 16 (Dale Mabry) Southern Connection Extension I-4 to Mt. Olive Road East-West Expressway M.P. 0 to M.P. 1.6		

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

VEHICLE SPOT SPEED STUDY

FORM 750-010-03
TRAFFIC ENGINEERING
09/97

LOCATION ID:	SECTION:
LOCATION:	Km P: MP:
POSTED SPEED (mi/h):	COUNTY:
DATE:	PAVEMENT CONDITION:
OBSERVER:	TIME FROM: TIME TO:
REMARKS:	

NUMBER OF VEHICLES _____ BOUND						SPEED	NUMBER OF VEHICLES _____ BOUND						BOTH DIRECTIONS	
CUM. TOTAL	TOTAL	20	15	10	5	(mi/h)	20	15	10	5	TOTAL	CUM. TOTAL	TOTAL	CUM. TOTAL
						-0								
						-0								
						9								
						8								
						7								
						6								
						5								
						4								
						3								
						2								
						1								
						-0								
						9								
						8								
						7								
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						4								
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						8								
						7								
						6								
						5								
						4								
						3								
						2								
						1								
						-0								
						-0								
		TOTALS								TOTALS				

SPEED DATA SUMMARY	_____ BOUND	_____ BOUND	BOTH DIRECTIONS
85th PERCENTILE SPEED			
10 mi/h PACE	~~~~~	~~~~~	

ENGINEER: ____________

DATE: ____________

RECYCLED PAPER